

Software Testing and Verification

Problem Set 1: Black-Box Testing

fmod():

1. List of Causes/Effects with descriptions

Effects:

21. fmod(x,y) returns the value $x - y \cdot \text{FLOOR}(x/y)$ and errno is not set
22. fmod(x,y) returns the value $x - y \cdot \text{CEILING}(x/y)$ and errno is not set
23. fmod(x,y) returns the value NaN and errno is set to EDOM
24. fmod(x,y) returns the value NaN and errno is not set
25. fmod(x,y) returns the value x and errno is not set

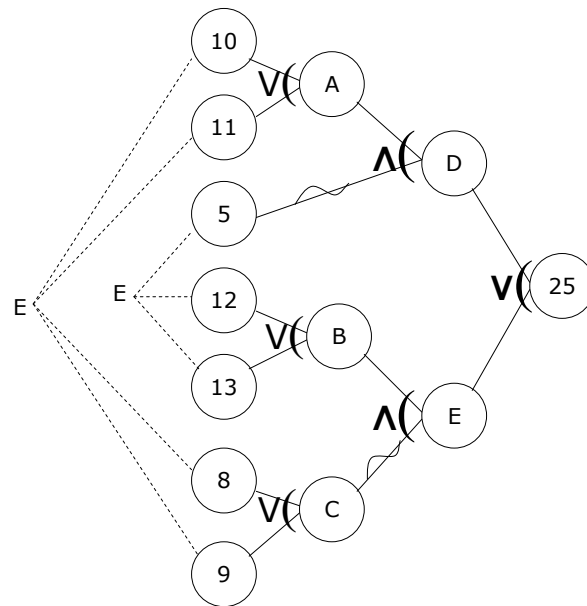
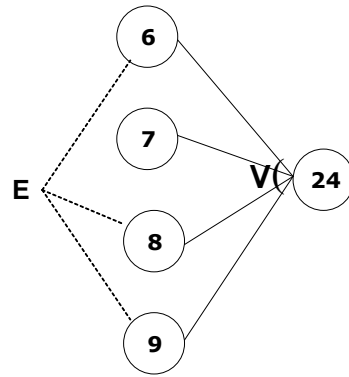
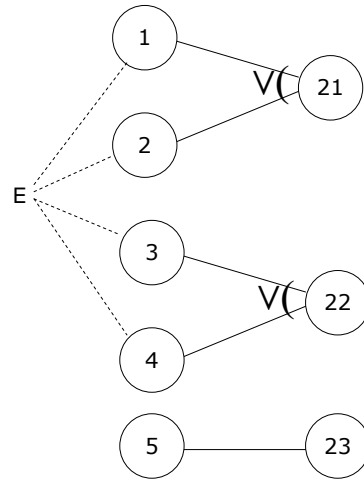
Causes:

1. $x > 0, y > 0 \Rightarrow x/y > 0$
2. $x < 0, y < 0 \Rightarrow x/y > 0$
3. $x > 0, y < 0 \Rightarrow x/y < 0$
4. $x < 0, y > 0 \Rightarrow x/y < 0$
5. $y = 0$
6. x is NaN
7. y is NaN
8. $x = +\text{Inf}$
9. $x = -\text{Inf}$
10. $x = +0$
11. $x = -0$
12. $y = +\text{Inf}$
13. $y = -\text{Inf}$

Note: In addition to the constraints explicitly represented in the Cause-Effect graph, the following is assumed but not represented in the graph (or the test case coverage matrix):

$$(1 \vee 2 \vee 3 \vee 4) \Rightarrow \text{NOT}(5 \vee 6 \dots \vee 13)$$

2.



3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
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25													T	T	T	T	T	T	T	T

Note: for Effects, values for blank entries are false. For Causes, values for blank entries are deducible from model constraints.

4. possible input boundary values: +Inf+e, +Inf, +Inf-e, +HUGE_VAL+e, +HUGE_VAL, +HUGE_VAL-e, +TINY_VAL+e, +TINY_VAL, 0.0, -TINY_VAL, -TINY_VAL-e, -HUGE_VAL+e, -HUGE_VAL, -HUGE_VAL-e, -Inf+e, -Inf, -Inf-e, where "e" (epsilon) would probably have the value +TINY_VAL. (Note that not all of these values are necessarily meaningful.)

possible output boundary values: 0.0+/-e

5. - various input TYPE errors (non-numeric chars, blanks, etc.), including a mix
 - no arguments; 1 argument; > 2 arguments
 - mixed combinations of very large and very small values of x and y

sort:

1. List of Causes/Effects with descriptions

Effects: values produced/written by sort and exit values set

31. sort results are written to a specified output file
 32. sort results are written to standard output

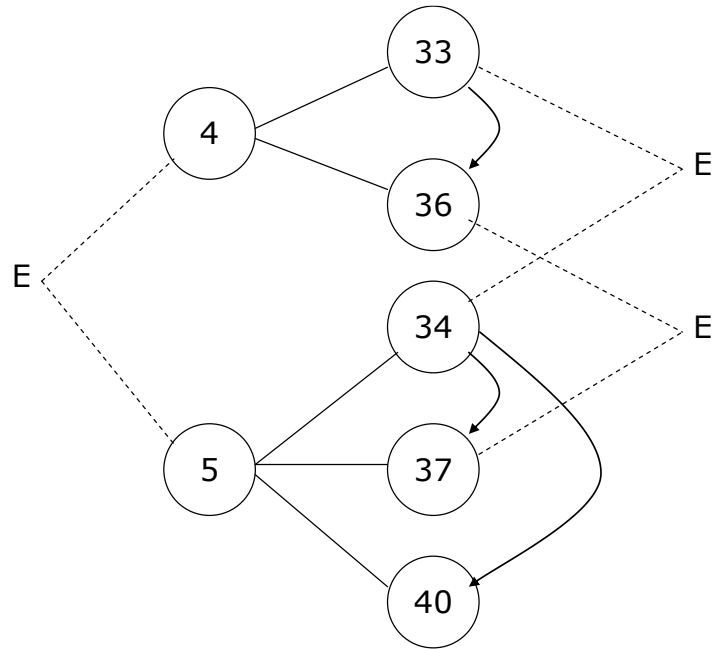
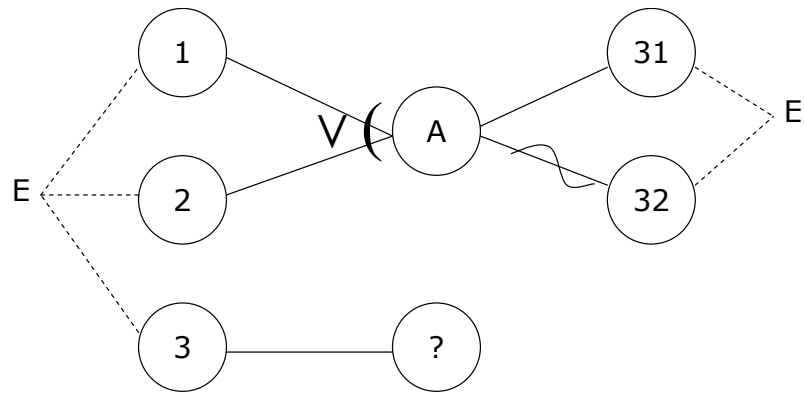
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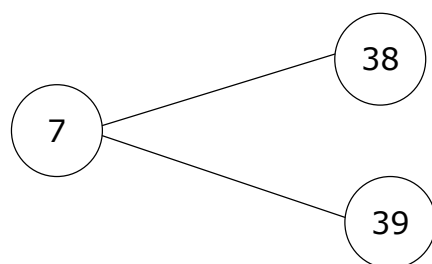
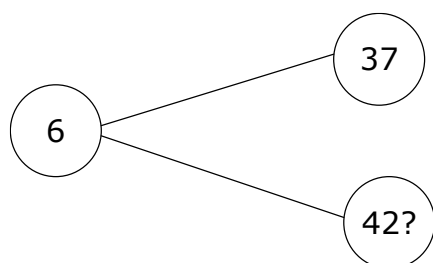
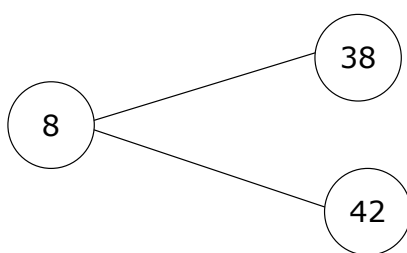
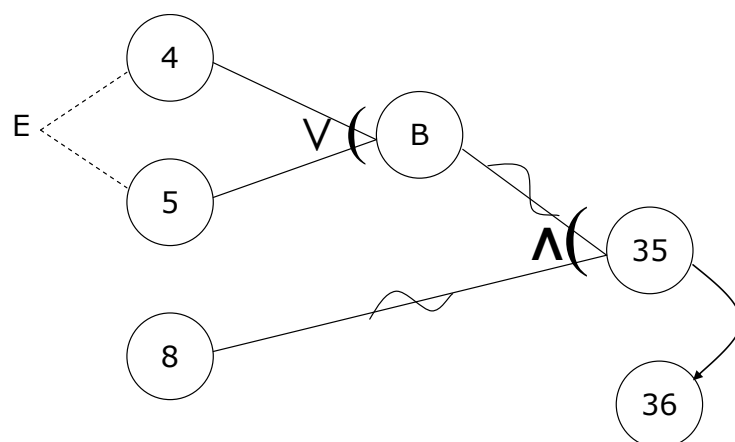
- 33. single input file is checked and found to be in order as specified by the arguments and the collating sequence of the current locale; exit code set; no output produced
- 34. single input file is checked and found NOT to be in order as specified by the arguments and the collating sequence of the current locale; exit code set; output is produced
- 35. all input files are output (sorted or merged) successfully
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- 36. exit code set to 0
- 37. exit code set to 1
- 38. exit code set to >1
-
- 39. a comment is output re input lines being too long
- 40. a comment is output re disorders discovered
- 41. a comment is output re the last line of an input file missing a new-line character
- 42. a comment is output for a trouble condition other than input lines being too long, disorders discovered, or a missing new line character
-
- 43. sorting result is merged input files
- 44. all but 1 of each equal line is suppressed in result
- 45. sorting is based on ASCII order
- 46. sorting is case insensitive (or lower-case letters are folded into upper-case)
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- 47. sorting is in "Dictionary" order -- only letters, digits, and blanks (spaces and tabs) are significant in comparisons.
- 48. sorting result is based on non-printable characters being ignored
- 49. sorting is in "Month" order
- 50. sorting result is based on the sense of comparisons being reversed
- 51. sorting result is based on leading blank characters in a line being ignored in comparisons
- 52. a new-line character is appended to the last line of the input file; a warning message is produced and sort continues
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- 53. standard (terminal) input is sorted or checked
- 54. one or more specified input files are sorted, merged, or checked

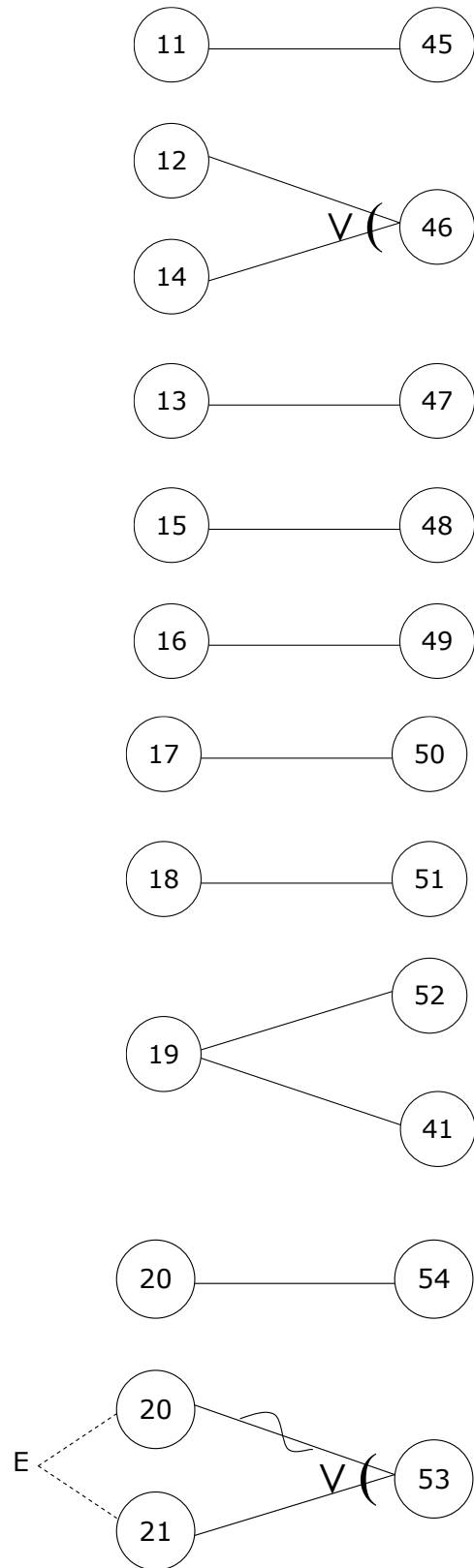
Causes:

1. -o option is present together with a specified output file that is the same as one of the input files
2. -o option is present together with a specified output file that is NOT the same as any of the input files
3. -o option is present with NO specified output file
-
4. -c option is present and specified input file is correctly ordered
5. -c option is present and specified input file is not ordered as specified
6. -c and -u options are present and two input lines are equal
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7. (one or more) input lines are too long
8. an error occurred
-
9. -m option is present
10. -u option is present
-
11. LC_COLLATE is set to C
12. LC_COLLATE is set to en_US
-
13. -d ordering option is present
14. -f ordering option is present
15. -i ordering option is present
16. -M ordering option is present
17. -r ordering option is present
18. -b ordering option is present
-
19. the last line of an input file is missing a new-line character
-
20. one or more pathname file operand(s) is/are present
21. a "-" file operand is present

2.







3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
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NOTE: Templates may be combined to reduce the number of test cases that are actually implemented.

4.
 - input line lengths are 0, 1, MAX_LINE_LENGTH, MAX_LINE_LENGTH+1
 - input file is sorted; sorted except for one line
 - output file size is 0, 1, MAX_SIZE; MAX_SIZE+1
 - number of files is 0, MAX_FILES, MAX_FILES+1

5.
 - define LC_COLLATE to be something other than expected
 - same option used more than once
 - missing input file name, incorrect filename
 - use of unsupported options (like -0 instead of -o)
 - non-ASCII characters in input file(s)
 - multiple identical input files
 - input file with same line repeated for all lines and -u option
 - input file with different lines, each repeated twice, and -u option
 - input file with no letters, digits, or blanks, and -d option
 - etc.

Some questions for the requirements engineer/specification author:

What if -o option appears without a specified output file?
 What if -c option appears without a SINGLE input file?
 What if -m option appears with a SINGLE input file?
 What if -m option appears and the input files are NOT sorted?
 What "errors" result in what exit values >1?